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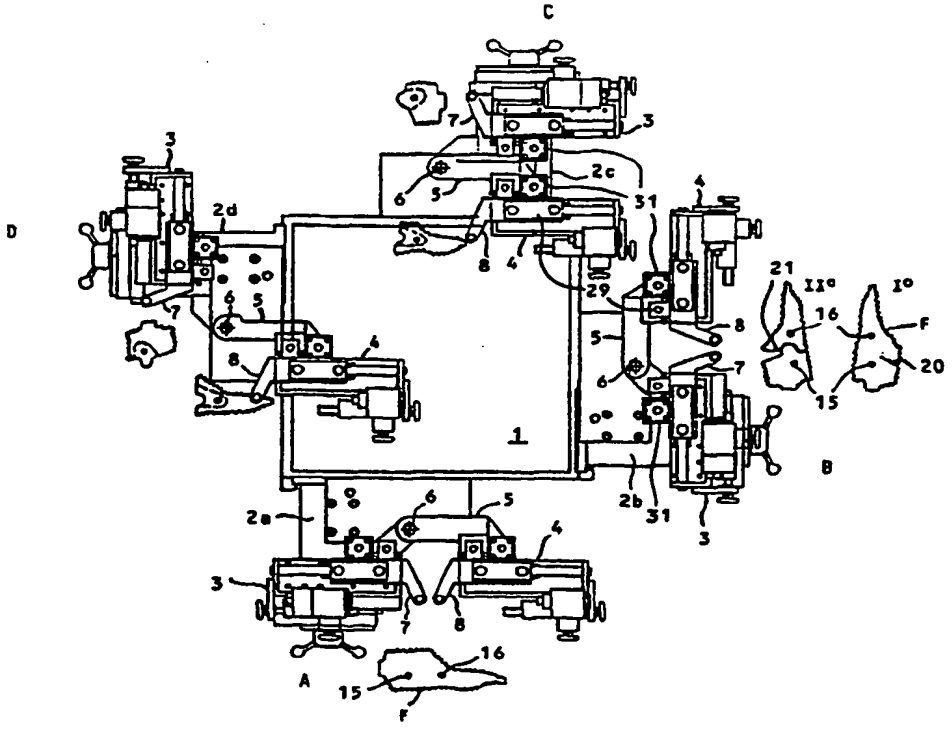
(57) Abstract

Articulated forms for shoe manufacturing, starting from rough-shaped forms are obtained by a continuous, highly automated process, by employing an automatic machine with a rotating table equipped with four identical anchoring and handling groups of the forms to be processed, disposed on four orthogonal sides of the table. Each group has a first saddle body (3) and a second body (4) which is mounted on a swinging arm (5). The groups cross in succession four work stations (A, B, C, D). A coordinated action of the two blocks (3, 4) and of the respective blocking means (9, 10, 7, 8), permits rotation of the form about its longitudinal axis, the performance of one or several cuts (20, 21) for defining a certain configuration of the separation surfaces of the form in two parts, each of which is alignedly retained by pins of a clamp. A realignment of the two parts while inserting and blocking the ends of a hinging insert (25) completes the assembly of the articulated form. An inventory of interchangeable clamps (7, 8) permits to equip the machine for realizing different types of articulation.



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"AUTOMATIC MACHINE FOR FABRICATING ARTICULATED FORMS FOR SHOE MANUFACTURING, STARTING FROM ROUGH-SHAPED MOLDED PIECES"

The present invention relates to a process and to an automatic machine for fabricating articulated forms for producing shoes.

The shoe industry employs articulated forms reproducing a human foot on which certain crucial fabrication steps during a shoe manufacturing process are performed, particularly during the modelling of the "uppers" and their joining to the sole. A peculiar feature of these forms is that of being provided with an articulation in a position corresponding more or less to the junction between the metatarse and tarse bones of a human foot, in order to permit a flection of the form for extracting it out of the finished shoe. Another peculiarity of these articulated forms is their relative uniqueness in terms of size of the shoe to be produced on the particular form as well as in terms of the shape of the shoe. Naturally this last aspect is extremely variable, in so far it determines the aesthetic character of the particular shoe model as well as its wearability and comfort.

These peculiarities exclude standardization of the forms, which must be purposely made for each new model (and size) of shoe, with its peculiar volumetric characteristics set by the fashion designer.

Manufacturing of these articles comprises: injection molding a rough-shaped body of a plastic material, as for example a polyethylene, trimming the molded body, sawing the rough-shaped form in two parts, a forefoot part and a heel part. The separation faces of the two parts may have an arcuate or cylindrical shape, respectively convex and concave, or a step in order to permit a certain rotation about a transversal axis

parallel to the sole plain, or a reciprocal sliding of the separation surfaces stopped by a purposely formed step of the separation surfaces. The two parts of the form are hingedly connected together by a spring (or other metallic connecting insert), which commonly fits into cavities purposely formed in the separation surfaces of the form. The connecting insert has its ends fastened to the respective part of the form by pins or similar fastening element. Commonly, in case of a spring-type connection the assembled articulated form has a "bistable" behaviour that is the form is capable of assuming a mechanically stable extended configuration or a mechanically stable flexed or bent configuration.

The rough-shaped articulated form must then be machined and finished in order to shape the form so that it will reproduce (in volumetric terms) the model or shoe to be manufactured.

Normally, being the rough-shaped form as obtained by molding and rough machining, already reproducing though in a grossly approximates way the definitive desired volumes, the further steps that lead to the realization of an articulated form may hardly prescind from cutting the rough-form in two parts reassembling of the two parts into an articulated rough-shaped form, before proceeding with the finishing machining steps. The impossibility or inconvenience of starting from separately molded heel parts and forefoot parts that could be separately molded in an efficiently standardized way, has made automation difficult and customarily fabrication of articulated forms is largely carried out in a substantially manual or semiautomatic way.

In fact, the need of generating separation articulation surfaces having certain discontinuities, for example for generating one or two opposed indentations and arcuate articulation surfaces as in a so-called

"hinged-last (ALFA) articulation, or other types of slidingly cooperating straight or arcuate surfaces, that may be provided with a step-like feature as in a so-called slide-o-matic hinged last (TENDO) articulation, often implies the need to carry out a succession of partial cutting operations, often acting in succession from one side and from the other side of the form, before effecting a last separating cut. These peculiarities of the fabrication process have in the past prevented an effective automation of the various steps of fabrication in an organic and complete way.

Therefore the is a clear need and/or utility for a process and a substantially automatic machine which, starting from a rough-shaped form would produce a fully assembled rough-shaped, articulated form, ready to undergo a finishing of its external surface, in a substantially automatic way so as to reduce the man power required and therefore the overall cost of a manufactured articulated form.

This objective is fully met by the present invention that relates to a process and an automatic machine capable of effecting, in succession, a number of machining operations and separate handlings of the two parts in which, at a certain point of the process, the rough-shaped form is cut, as well as the reassembling together of the two parts to form an articulated rough-shaped form, ready for undergoing finishing of its external surface.

Basically, the process comprises a sequence of steps or operations that take place in a substantially unattended way in four distinct work stations that are reached in succession by each rough-shaped form, which is loaded in a first work station, wherein a completely reassembled articulated form is unloaded.

In such a first work station of "loading and transversal boring", a rough-shaped form, still

integral, is set horizontally, preferably with its sole plane vertical, between a turnable chuck for rotating the form and a tailpin. A first operating unit automatically produces a plurality of transversal holes, spaced from each other along a substantially longitudinal extension of the form. The transversal holes will serve for inserting retaining metal pins for a spring or similar hinging mechanism of the articulation to be realized. Automation organs load the required metal pins in receptacles of the arms of a pair of automatically operated clamps.

The pin holding arms of the clamps that will retain the respective part in which the form will be divided, are interchangeable, in order to prearrange a clamp configuration corresponding to the number and geometrical disposition (pattern) of the transversal holes that are drilled through the form for realizing a particular type of articulation. An upper arm of each clamp has receptacles equipped with an automatic retention/release mechanism suitable to hold and eventually insert a protruding portion of a metal pin loaded therein in the respective hole of the form, while the lower arm of the clamps may be simply provided with fixed protrusions suitable to fit into the respective end of the transversal holes, or viceversa.

Eventually, the form advances to a second work station whereat the form, still integral and turnable about its longitudinal axis, may be subjected to a succession of cutting operations, starting alternately from one side and from the other side, depending on the type of articulation that must be realized, without completing the separation in two parts of the form yet. Before producing a final or a unique separating cut, generating for example opposed cylindrical surfaces, one concave and the other convex, or a step-like discontinuity in case of a sliding type articulation, the

clamps are automatically extended to align the partially protruding pins with the respective holes of the form and a "floating" actuating cylinder commands the closing of the two arms over the form thus inserting partially one or more pins that were previously loaded in one of the two arms, in the respective transversal holes of each of the two parts into which the form will be divided eventually by said last cut.

The fundamental feature is that while the closing of the two arms of each of the clamps is carried out in a "floating" manner, that is in disregard of the actual shape and dimensions of the rough-shaped form, once the clamps are closed over the form (and therefore the pins and the protrusions partially fitted into the ends of the transversal holes drilled through the form), the whole floatingly supported clamp assembly is blocked in the precise spatial position assumed with the closing of the clamps' arms. This ensures, once the form is cut in two separate portions, that each part will remain precisely aligned on the original longitudinal axis of the mounting of the whole rough-shaped form. This permits an easily performed reassembly of the articulated form at the end of the process as will become clearer in the description that follows.

The partially inserted pins, still partially retained in the respective arms of the clamps, in cooperation also with the protrusions of the opposite arm of each clamp that fit into the other end of the transversal holes, retain separately the two parts of the form, once separated, against the respective chuck block and tailpin block. Therefore, once the separating cut has been completed, each part of the form will independently be firmly held by the respective clamp, the spatial position of which is blocked as mentioned above, through one or more pins that at this stage are only partially inserted in the transversal holes of the

part of the form, with one arm and through one or more protrusions partially fitting in the opposite ends of the transversal holes, with the other arm of the clamp.

In a third work station to which the separately held parts of the form are advanced, one part of the form, that is the relative anchoring group, rotates to a parallel (side-by-side) position with the other part of the form that is held in another spatially fixed anchoring group, in order to present both separation surfaces of the form to the action of a chain indenter or of a milling cutter that forms a cavity in each part of the form, of a shape suitable to receive and house the respective portion of a spring or of an equivalent elastically hinging insert.

In a fourth and last work station, automation organs insert one end of a spring or of an equivalent hinging insert into the cavity of one of the two parts of the form and advance to a final position at least one of said pins (that was partially inserted in a transversal hole and which is still partially engaged in the retention/release mechanims of the arm of the respective clamp) fully inside the transversal hole in order to engage with a terminal hook or eyelet portion of the spring thus blocking inside the cavity the extemity of said spring or hinging insert. The two parts of the form are thereafter realigned by swinging back to its original position said anchoring group of one of the two parts and a mechanism provides to push the two parts together while inserting the other end of the spring or hinging insert in the cavity of the other part of the form and fully advance at least a second pin into the respective transversal hole of the other part of the form to engage with the respective end of the connecting spring or hinging insert, thus completing the assembly of the articulated form, which by returning to the first work station is unloaded from

its machine mount, its place being eventually taken by a new integral rough-shaped form to be subjected to the same process.

An automatic machine of the invention may comprise a rotatable table having four identical anchoring and handling groups handling four forms at a time, functionally arranged on four orthogonal sides of the rotatable table so that each group will be advanced in succession through four distinct work stations, each equipped with special automated mechanisms and tools for carrying out the succession of operations of the above-described process, on the forms held in the four anchoring and handling groups of the machine.

The different aspects and advantages of the invention will be more easily understood through the following description of several important embodiments and by referring to the attached drawings, wherein:

Figure 1 is a schematic plan view of the rotatable table of a machine of the invention;

Figure 2 is a schematic elevation view of a first work station of the machine;

Figure 3 is a schematic elevation view of a second work station of the machine;

Figure 4 is a schematic elevation view of a third work station of the machine;

Figure 5 is a schematic elevation view of a fourth and last work station of the machine;

Figure 6 schematically shows the structure of the clamps of the machine;

Figure 7 schematically shows a belt sawing group according to a preferred embodiment thereof.

The illustrations and their pertinent description that follows refer to the case of realizing a bending-type articulation of the so-called hinged last (ALFA) type in a form, which implies the formation of at least a deep "V" shaped cut and thereafter an arcuate cut

from the sole face of the form to the vertex of said deep "V" shape cut, and which employs an arcuate connecting spring anchored by two pins inserted in a pair of transversal holes, one formed in the forefoot part and the other formed in the heel part of the form. Of course, other types of articulation, for example a so-called slide-o-matic hinged last articulation requiring more than two blocking pins of the connecting hinge and an arcuate separation cut with a stepped portion may be realized with the same machine of the invention, by simply adapting the tooling thereof, as for example by substituting the arms of the clamps, as will be described later, and by programmably modifying the succession of cuts or the single continuous cut to be performed.

With reference to Fig. 1, the machine comprises a rotatable table 1, equipped on four orthogonal sides thereof, with four identical anchoring and handling turrets or groups, indicated as a whole with 2a, 2b, 2c and 2d, respectively.

Upon an incremental (step-wise) rotation of the table 1 by 90° intervals, each anchoring and handling group reaches in succession four distinct work stations, schematically indicated in the figure with A, B, C and D. Each work station is equipped with automatic mechanisms and tools for performing certain machinings or manipulations on the forms present in the four anchoring groups 2a, 2b, 2c and 2d. Of course, the different operating mechanisms perform their specific functions simultaneously, after every incremental rotation by 90° of the table 1, on the four forms handled at a time by the machine.

Each anchoring and handling group is composed of two blocks: a first saddle body 3, mounted on guides onto the rotatable table 1 and a second block 4 that is mounted on a swinging arm or platform 5, pivoted at 6

on the rotating table 1.

Upon rotation of the platform 5, the second block 4 is capable of assuming a position operatively opposed (aligned along a common axis) to the first saddle body 3, in correspondence of the first work station A and of the second work station B, a parallel (side-by-side) position to said first saddle body 3 in correspondence of the third work station C and back to an aligned position in correspondence of the fourth work station D.

Each block 3 and 4, is equipped with an automatically operated clamp, respectively 7 and 8, each having an upper arm 7a and 8a and a lower arm 7b and 8b, respectively, suitable to independently hold the two parts into which a form will be eventually divided, as will be described later.

In order to increase intelligibility of the succession of the various operations that are carried out on the forms, the various steps according to a particular embodiment of the invention, are schematically depicted in the plan view of Fig. 1 by enlarged sketches of the form and of the two parts of a form being processed, drawn near to the four work stations A, B, C and D locations.

Further aspects and peculiarities of the machine of the invention, will be pointed out while describing a series of elevation views of the machine, each corresponding to one of the four work stations, operatively arranged along the four orthogonal sides of the machine.

The first work station A is schematically shown in Fig. 2. The structure of the rotatable table, indicated as a whole with 1, may be observed in greater detail in elevation views. The table comprises a central body 1a, rotatable by a motor-reduction gear group 1b. The rotatable table has four cross arms 1c, each provided with vertical and horizontal guides: 1e and 1d, respctively,

on which the base of the first saddle body 3 of the relative anchoring and handling group (2a, 2b, 2c, 2d) rests and whose position is adjustable by means of handwheels (1f), the function of which is evident and does not require a specific description.

Besides the respective clamps 7 and 8, the blocks 3 and 4 are provided with respective abutment terminals 9 and 10. At least a first abutment block 9 has an arresting surface provided with a protrusion suitable to determine a nonmutually turnable engagement with a depression or indentation caused by the protrusion itself in the plastic material of the form F. The nonmutually turnable coupling abutment permits to rotate the form F. The opposite terminal 10 may simply be a tailpin suitable to compress the form F. Both terminals 9 and 10 are mounted in turnable supports and the drag terminal 9 may be rotated in order to rotate the form F about a longitudinal axis, which may be parallel to the sole's plane though not necessarily so. In any case the actual longitudinal axis of the form, as compressively held between the terminals 9 and 10, will remain the same throughout the fabrication process, as will be described herein below.

The first work station A of the machine is equipped with a first operating group 11, provided with positioning mechanisms operating along two horizontal orthogonal axes and it may be supported by a framework 12. The operating group 11 comprises at least a drill chuck 13, equipped with a drill point 14. Programmable automation mechanisms exactly position the operator group 11 so as to drill the required transversal holes, 15 and 16 through the form F according to a certain pattern and substantially spaced from each other along a longitudinal dimension of the form F.

As mentioned above, depending on the type of hinged articulation to be produced, the transversal holes

drilled in the work station A of the machine may be more than two and have any spatial arrangement (pattern) on a longitudinally oriented cross sectional (horizontal) plane of the form.

Once drilling of the transversal holes 15 and 16 has been completed, handling organs (not shown in the figure) load metal pins, respectively 17 and 18, in special automatically controlled receptacles (sockets) of the upper arms 7a and 8a of the respective clamps 7 and 8 which, for the moment, are kept in a retracted and disengaged (open) position. The respective lower arms 7b and 8b of the clamps, are provided with fixed protrusions 17' and 18', aligned along the same axes of the metal pins receiving sockets of the upper arms.

The structure of the clamps 7 and 8 is such as to permit an easy substitution of the upper and lower arms, according to the type of articulation to be produced. An inventory of arm pairs, each designed for a certain configuration, will permit to manage a practically unlimited number of types of hinged articulations that may be produced with the machine of the invention.

An incremental rotation by 90° of the rotatable table 1 of the machine, shifts the form F that has just been drilled, to the second work station B, which is schematically depicted in Fig. 3.

According to a first embodiment, the form F, still held between the rotatable dragging terminal 9 and the tailpin 10, may be rotated by 180° by a rotating mechanism 27. The operating group of this second work station B may be constituted as shown in Fig. 3 by a belt saw 19, which is driven to perform a first inclined or arcuate cut 20, in a position comprised between the transversal holes 15 and 16, as schematically shown in the relative sketch (Ia) of Fig. 1. The form F is thereafter rotated again by 180°,

for example in an opposite direction to the first rotatation, thus resetting it to its original mount position. At this point, the clamps 7 and 8 are automatically extended until aligning the pins 17 and 18 and the protrusions 17' and 18' with the transversal holes 15 and 16 that were previously drilled through the form F. The pair of upper and lower arms are closed toward each other, thus partially inserting the pins 17 and 18 (still retained by their respective socket mechanisms of the clamps' upper arms) and the protrusions 17' and 18' in the holes of the form.

The peculiar structure of each of said clamps 7 and 8 is schematically depicted in Fig. 6. Each clamp, for example the clamp 8 of the swinging anchoring block 4, is carried by a sliding carriage 28 that eventually extends the clamp for aligning the metal pin 18, loaded in the retention-release mechanism 8b of the upper arm 8a of the clamp and the protrusion 18' of its lower arm 8b with a respective transversal hole 16 drilled across the form F, held in abutment against the tailpin 10. A first actuating cylinder 29 may be commanded to close the arms 8a and 8b one toward the other thus engaging the fixed protrusion 18' and a portion of the metal pin 18 into the opposite ends of the transversal holes 16. The clamp, including the actuating cylinder 29, is floatingly supported by the stem 30 of a second cylinder 31 that is fastened to the carriage 28 of the clamp. During the closing together of the two arms 8a and 8b of the clamp performed by the "floating" cylinder 22, the fluid recirculation conduit 32 of the cylinder 31 is open. This permits to the clamps' arms 8a and 8b to correctly close in toward each other, irrespective of which of the two arms will be "arrested" first against the rigidly held form surface, in order to exert an appropriate vice action on the form, irrespective of its actual size and shape. Once

the arms of the clamp are fully closed and therefore the protrusion 18' and the metal pin 18 are fitted into the transversal hole 16 of the form F, a valve 33 present in the recirculation conduit 32 of the cylinder 31 is automatically closed, thus blocking the spatial position assumed by the arms 8a and 8b of the clamp. This ensures that upon a subsequent separation of the form F in two parts, these will remain held individually by the respective clamp along the same longitudinal axis of the whole form F as originally mounted. This requisite is essential in order to permit a final reassembly of the two parts, as will become evident through the following description.

Therefore, the stability of the two (yet virtual) portions of the form is ensured by the blocking action exerted by the respective clamps 7 and 8, through the partially inserted pins 17 and 18 and the protrusions 17' and 18' set in the transversal holes 15 and 16 and the respective terminal 9 and 10.

Thereafter the belt saw 19 may be programmably driven to effect an arcuate cut 21, starting from the face of the sole of the form F to intersect the first produced cut 20, thus separating the form F in two parts, a heel part and a forefoot part, and continuing the cut through the residual thickness, thus determining the formation of a deep "V" shaped indentation or cut, as shown in the relative sketch (IIa) of Fig. 1.

The cut 21 performed by the belt saw 19, produces for a certain portion of the cut, surfaces of articulation that in the example shown are essentially cylindrical, one convex on the face of the heel part of the form and the forefoot concave on the face of the other part of the form.

While the belt sawing machine 19 that equips the second station B may be of a standard type as depicted

in Fig. 3, for example having advancement and rotation mechanisms housed in its basement for impressing the desired movements to be belt saw drive portion of the machine, according to a preferred embodiment of the invention, the work station B of the machine may be equipped with a belt saw suspended on the framework 12 of the machine through a cross-arm suspension, providing for the positioning of the belt saw along two orthogonal directions laying in a horizontal plane. Arcuate cuts are produced by the use of a special blade-twisting mechanism.

Such a preferred embodiment is schematically depicted in Fig. 7.

With reference to Fig. 7, the belt saw assembly indicated as whole with 19, is suspended on the framework 12 through a cross-arm suspension whereby the spatial position of the assembly may be programmably determined by displacements along the orthogonal suspension shafts 34 and 35.

An electric motor 36 drives through a belt-pulley transmission 37 a drive pulley 38 of a belt saw 39 running over at least two other pulleys 40 and 41. The tensioning of the belt saw 39 may be adjusted by displacing the pulley 40.

A substantial length of the belt saw 39, in the cutting zone of the machine, is engaged at two spaced points by radially slotted guiding and twisting blocks 42 and 43 that provide for an abutment surface for the back edge of the running belt saw 39. The two blocks 42 and 43 may be rotated by respective drive gears 44 and 45. A coordinated turning of the slotted blade twisting blocks 42 and 43 is provided by twin, toothed belt transmissions, 46 and 47. A stepping motor 48 controls through the shafts 49 and 50, the toothed belt transmissions 46 and 47 and the shafts 51 and 52 the angular orientation of the blade twisting slots or the

two blocks 42 and 43. The transmission may be provided with releasable organs for correctly aligning the blade guiding and twisting blocks 42 and 43. Replacement of the tape blade 39 is not hindered by the blade twisting mechanim, the blade engaging portions of which are all provided with a radial slot for passing the blade therebetween.

By using a belt saw with a width comprised between 6 and 7 mm, the slanting mechanism of the belt sawing group of Fig. 7 equipping the work station B of the machine of the invention makes possible through a coordinated command of the advancement of the blade and of the blade slanting mechanism, to effect arcuate cuts and also step-like discontinuities along the cut. This ability permits in many cases to effect the necessary separation cut through a single operation, without the need for turning the form between successively performed cuts. Also in case of an articulation of the type illustrated in Fig. 1, the belt sawing machine provided with belt twisting mechanism, according to Fig. 7, permits to carry out the necessary cutting operations without turning the form F along its longitudinal axis. The required deep "V"-shaped indentation may be carried out by driving exclusively the belt saw.

A further rotation by 90° of the rotatable table 1 of the machine brings the drilled and cut form, the two portions of which are independently held in the respective anchoring blocks 3 and 4, to a third work station C of the machine, depicted in Fig. 4.

As may be observed also in the plan view of Fig. 1, the second block 4, mounted on the turnable platform 5, is rotated by 180°, bringing it to a position parallel to the first saddle body 3. In this way, the two separation faces of the two parts (heel and forefoot portions) in which the form F has been cut in the pre-

ceding work station, are disposed one beside the other.

In this phase, the heel portion that is held by the respective clamp 7 of the first saddle body 3, is preferably backed automatically by a distance of few centimeters, by shifting backward the block carriage, in order to prearrange the parts of the form for the assemblying operations that will be subsequently carried out.

The work station C is equipped with an operating group 22 which, as shown in the example, may comprise a chain saw 22a suitable to form a cavity in each of the two articulation faces of the two portions of the form.

The adjustment of the slant angle of the chain saw 22a about a horizontal axis of advancement of the chain saw during the milling of the two cavities, permits to create cavities inclined about the longitudinal axis of the form, according to requirements of a bistable functioning of a connecting arcuate spring to be housed in the two inclined cavities for the sample articulation shown.

The last work station D of the machine, schematically depicted in Fig. 5, is equipped with an operating group 23 which may also be slidably supported by a framework 12 of the machine. The group comprises a handler 24 suitable to insert the end of a connecting spring 25 inside the cavity of one of the two parts of the form F, in the shown example into the heel portion thereof. Other manipulating organs 26 push the respective pins 17 fully inside the transversal hole 15 of the heel portion of the form so as to engage and retain the end of the connecting spring 25 pushed therein by the handler 24.

Once the anchoring of one end of the connecting spring inside the heel portion of the form has been completed, the swinging block 4, on which the other portion (forefoot portion) of the form is held, swings

back into alignment with the first saddle block 3 (as depicted in Fig. 1), causing the other end of the connecting spring 25 to be received inside the respective cavity of the forefoot portion of the form F.

By virtue of the blocking of the spatial position of the respective clamps 7 and 8, as described above, the two portions of the form F will be still perfectly aligned, but spaced by the backing distance of the heel portion that was effected previously in work stations C. This prearranged backing by few centimeters of the portion of the form permits a realignment of the two parts and the insertion, though incomplete, of the other portion of the spring in the respective housing of the forefoot part brought into alignment with the heel portion, without the need to overcome any contrasting force exerted by the spring.

At this point, and with the swinging block 4 back in alignment with the first saddle body 3, the carriage holding the heel portion is pushed on its relative guide toward the forefoot portion, overcoming the contrasting force exerted by the connecting spring, which flexes and, when the two surfaces of the articulation abut one against the other, the pin 18 is pushed inside the transversal hole 16 of the forefoot portion of the form F, blocking in a functionally stable arrangement, the other end of the connecting spring, thus completing the assembly of the articulated form.

A subsequent incremental rotation by 90° of the rotatable table will bring the articulated form back to work station A, where it will be unloaded from the anchoring and handling unit, on which a new rough-shaped form will be loaded.

In realizing the machine of the invention described above, many modifications are possible, though remaining within the spirit and scope of the invention. In particular, the orientation of the form mounted on

the anchoring and handling blocks of the machine may also be different from the one illustrated. The operating groups of the various work stations may be mounted differently in order to act along different axes than the one shown in relation to the particular anchoring arrangement of the forms being processed.

Of course, the work station A of the machine may be equipped with automatic unloading devices for the completed articulated form and loading devices for mounting a new rough-shaped form to be processed, in alternative to the attendance of an operator that would manually dismount and mount the forms at the work station A.

C L A I M S

1. A machine for producing an articulated form for shoe manufacturing starting from a rough-shaped form, characterized by comprising

a rotatable table (1) equipped with at least four identical anchoring and handling devices (2a, 2b, 2c, 2d) for the same number of forms (F), disposed on four sides of said rotatable table (1), each comprising a first saddle body (3), and a second body (4) mounted on a swinging arm (5) pivoted on said table (1) and capable of assuming a position alignedly opposed to said first saddle body (3) and a position parallel to said first saddle body (3) and viceversa;

a framework (12) supporting a plurality of operating groups (11, 19, 21, 23, 26) in correspondence of a plurality of work stations (A, B, C, D) that are reached in succession by each of said anchoring and handling devices upon an incremental rotation of said table (1);

a first work station equipped with a first operating group (11) comprising at least a drill (13, 14), suitable to drill holes (15, 16) through said form (F), at least at two positions spaced along a longitudinal dimension of said form (F);

a clamp (7, 8), composed of an upper arm (7a, 8a) and a lower arm (7b, 8b) associated with each of said first saddle body (3) and second body (4), and having an arm provided with receptacles for receiving pins (17, 18), means for extending said clamps to align said pins (17, 18) with said transversal holes (15, 16), first floating cylinder means (29) for closing together said arms over said form (F), second cylinder means (31) for blocking the spatial position of the clamped form (F) before cutting it into two parts;

a second work station (B) equipped with a second

operating group consisting of a belt saw (19) for producing a separation cut (20, 21) through the form (F) in a position comprised between said holes (15, 16);

a third work station (C), equipped with a third operating group (22) comprising a chain saw or mill (22a) suitable to mill cavities in the separation surfaces of said two parts of form (F) after swinging said second body (4) carrying one part of the form (F) to a parallel position with the other part held in said first saddle body (3);

a fourth work station (D) equipped with a fourth operating group (23) comprising handling means (24) capable of inserting one end of a connecting metal insert (25) in the cavity of one of said two parts of the form (F) and to complete the insertion of the relative pin (17) into the respective transversal hole (15), thus engaging and blocking the end of said insert (25) inserted in the cavity, the swinging arm (5) being subsequently rotated so as to realign the two parts of said form (F) and means capable of compressing together in abutment the separation surfaces of said two parts of the form against an elastically contrasting force exerted by said insert (25), the other end of which fits into the cavity of the other part of the form and of inserting the relative pin (18) inside the respective transversal hole (16), thus completing the assembly of said articulated form (F).

2. A machine as defined in claim 1, wherein said connecting metal insert (25) is in the form of a curved spring, and said means for compressing together the separation surfaces of the two parts of the form comprise a slide mount of said first saddle body (3), which is backed by a certain distance in said third work station (C) and is advanced by the same distance in said fourth work station (D), against the

contrasting force of said spring (25).

3. A machine as defined in claim 1, wherein said other arm (7b, 8b) of each of said clamps (7, 8) is provided with at least a protrusion (17', 18'), capable of fitting inside the other end of the transversal hole (15, 16) into which is partially inserted the relative pin (17, 18).

4. A machine as defined in claim 1, wherein both the upper arm (7a, 8a) and the lower arm (7b, 8b) of each of said clamps are replaceable with any one of a plurality of interchangeable arms, each pair of arms being compatible with a particular configuration of said transversal holes (15, 16) that receive said pins and said protrusions.

5. A process for preparing an articulated form for shoe manufacturing starting from a rough-shaped form, characterized by performaning specific work steps in four distinct work stations that are crossed in succession by each form by incremental advancement from one station to the next, in the following order:

- in a first work station:
  horizontally mounting a form by compressing it between two turnable terminals, a first dragging terminal being mounted on a first saddle body and a second tailpin terminal being mounted on a second body alignedly supported on a swinging arm;
  drilling at least two transversal holes in said form spaced from each other along a substantially longitudinal dimension of said form;
- in a second work station:
  positioning, closing and blocking a pair of clamps, respectively carried by said first and by said second body, while partially inserting at least a

pin, previously loaded into a receiving chuck hole of an arm of each of said clamps, into said transversal holes, and

performing at least a separation cut, splitting the form in two parts, each being independently and alignedly held by said clamps;

- in a third work station:

swinging said second body carrying one of said two parts of form by 180°;

forming a cavity in each of the separation surfaces of the two parts of form disposed one beside the other; and

- in a fourth work station:

inserting one end of a connecting member in the cavity formed in the part of the form held on said first saddle body and pushing the relative pin fully inside the transversal hole to engage and block therein the end of said connecting member;

swinging by 180° said second body carrying the other part of form back in alignement with said saddle body while inserting the other end of said connecting member in the respective cavity, pushing the separation surfaces of the two realigned parts of the form in abutment with each other and pushing the relative pin fully inside the transversal hole into engagement with the other end of the connecting member thus completing the assembly of the articulated form.

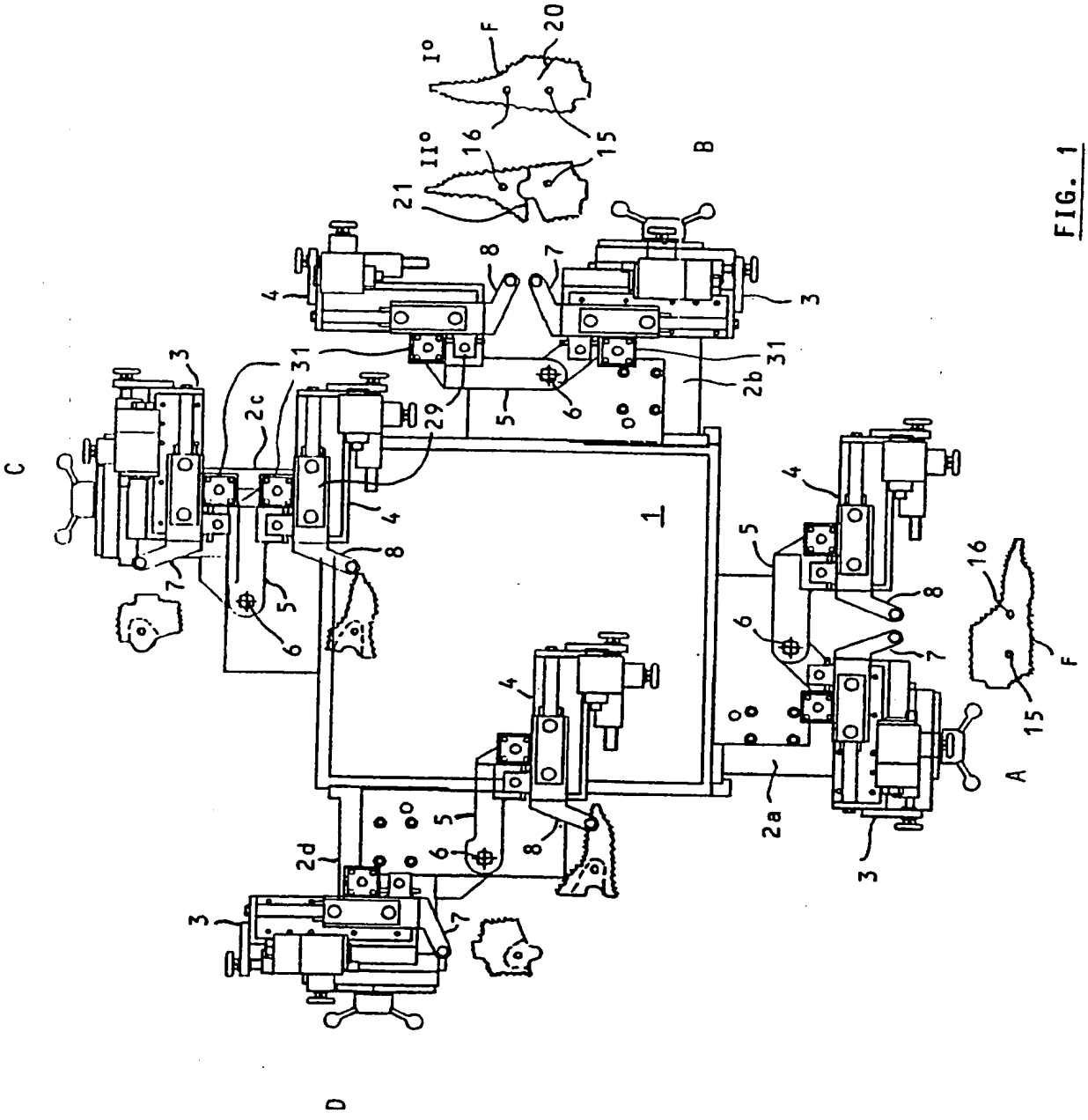
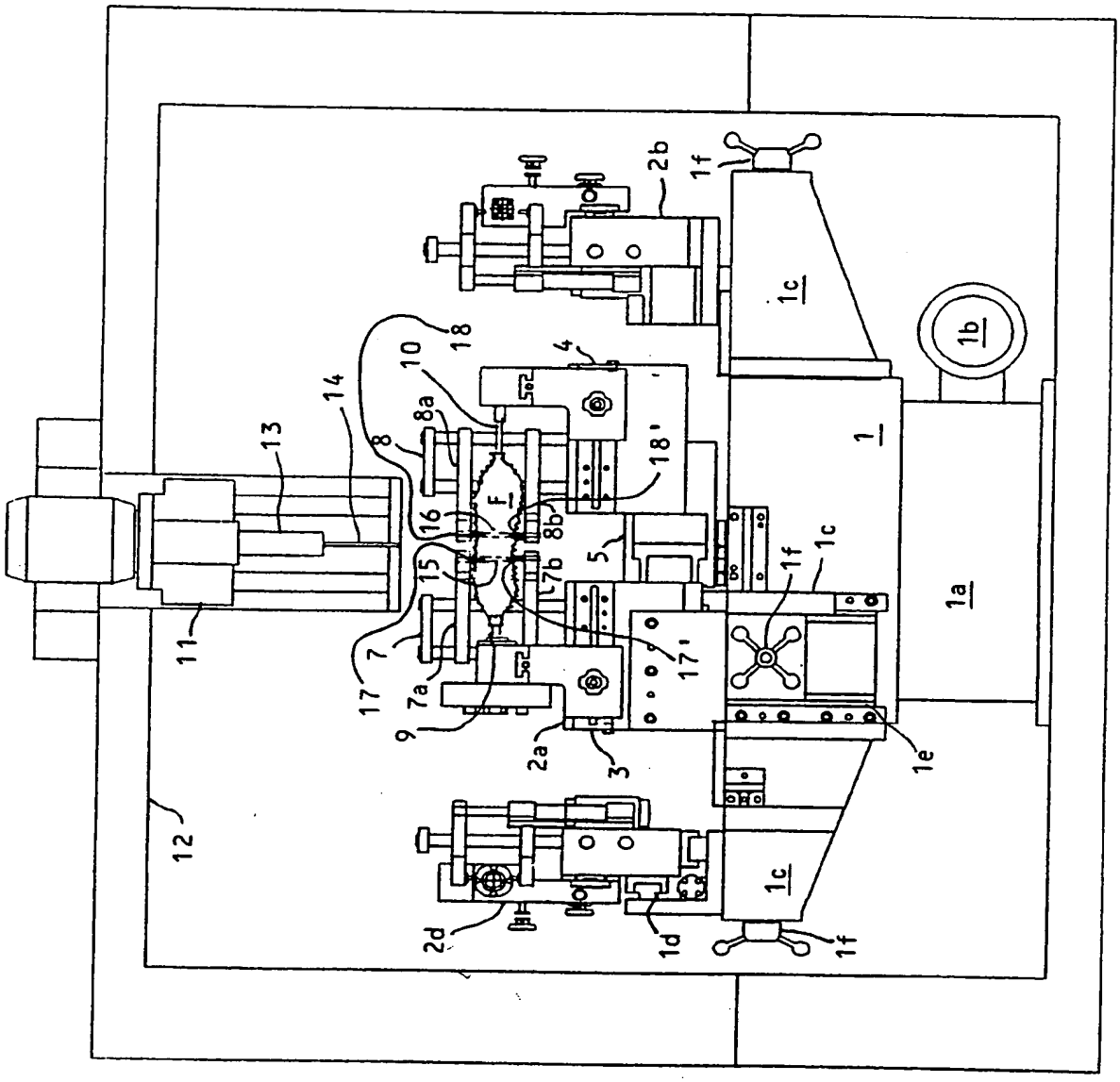


FIG. 1

FIG. 2



17, 18 metal pins.

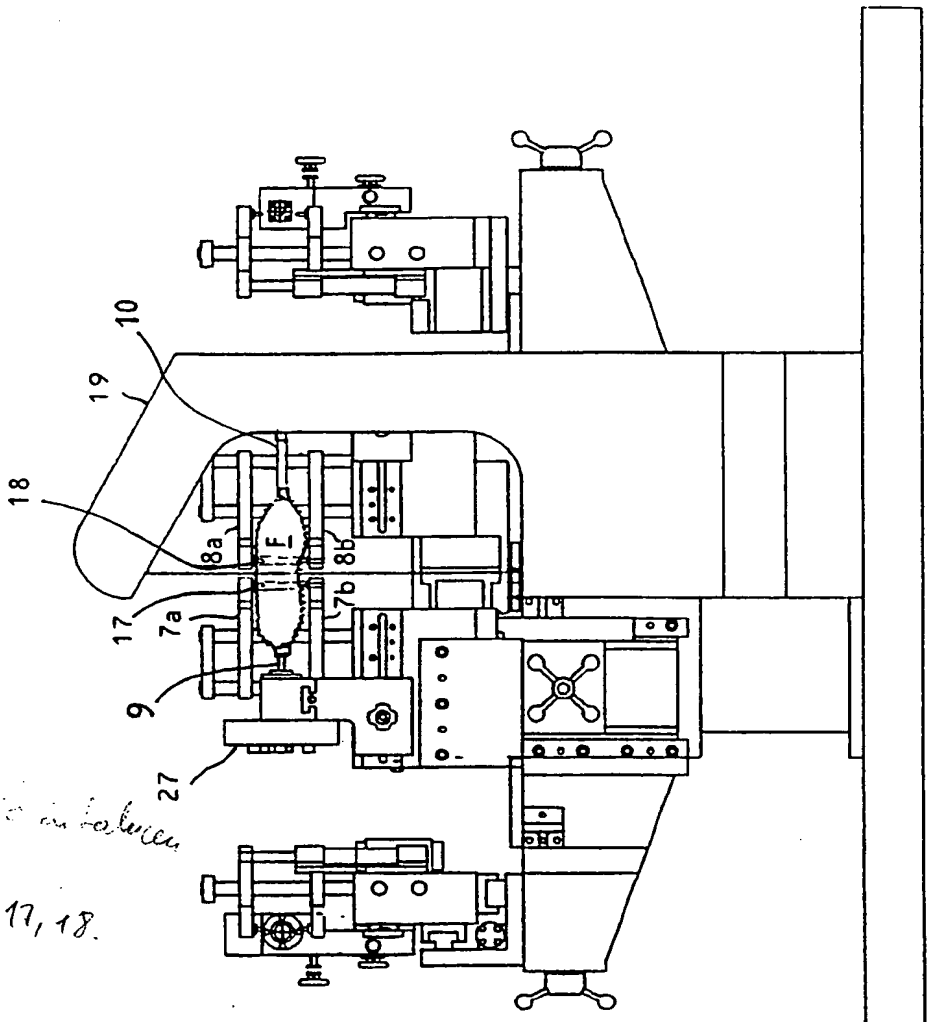


FIG. 3

FIG. 4

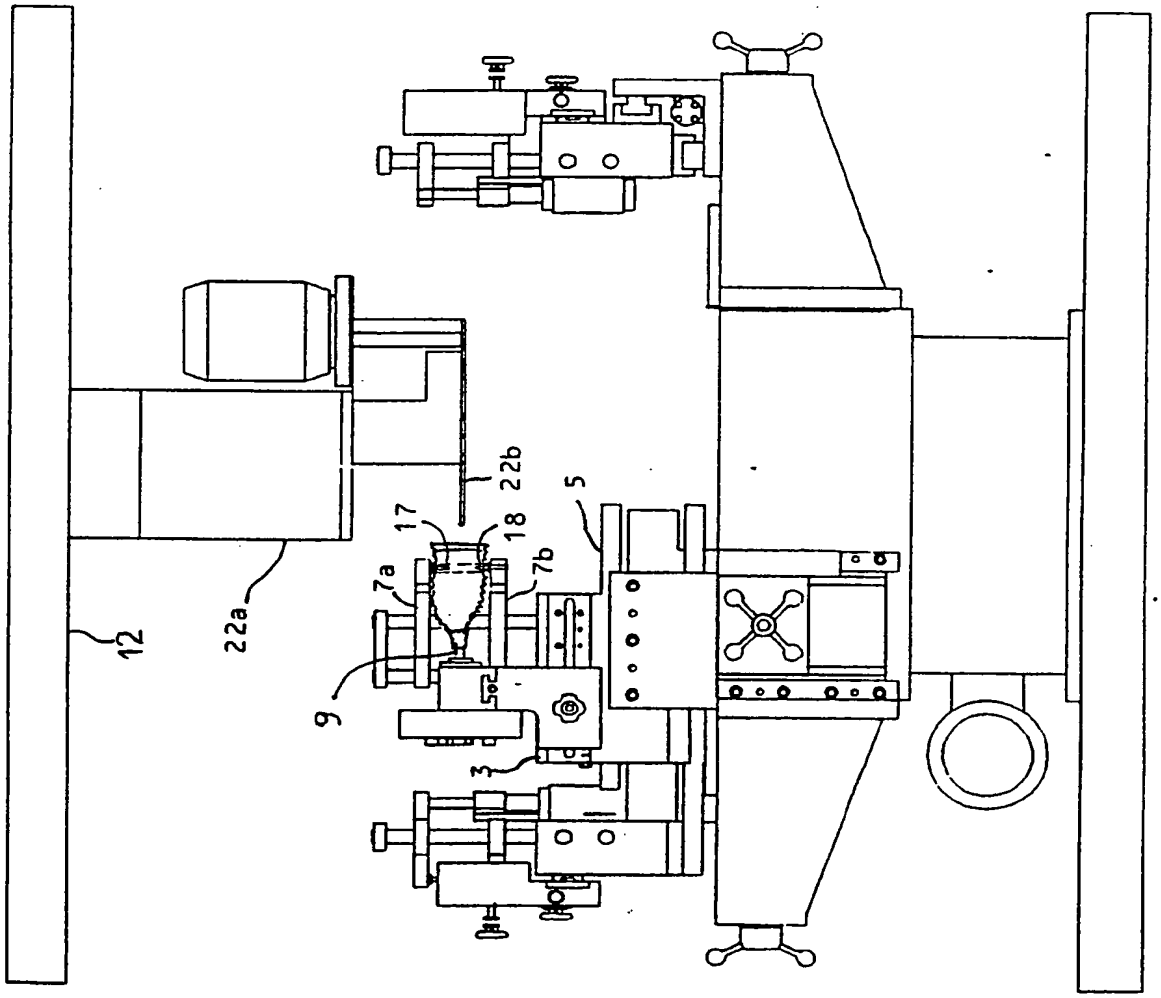
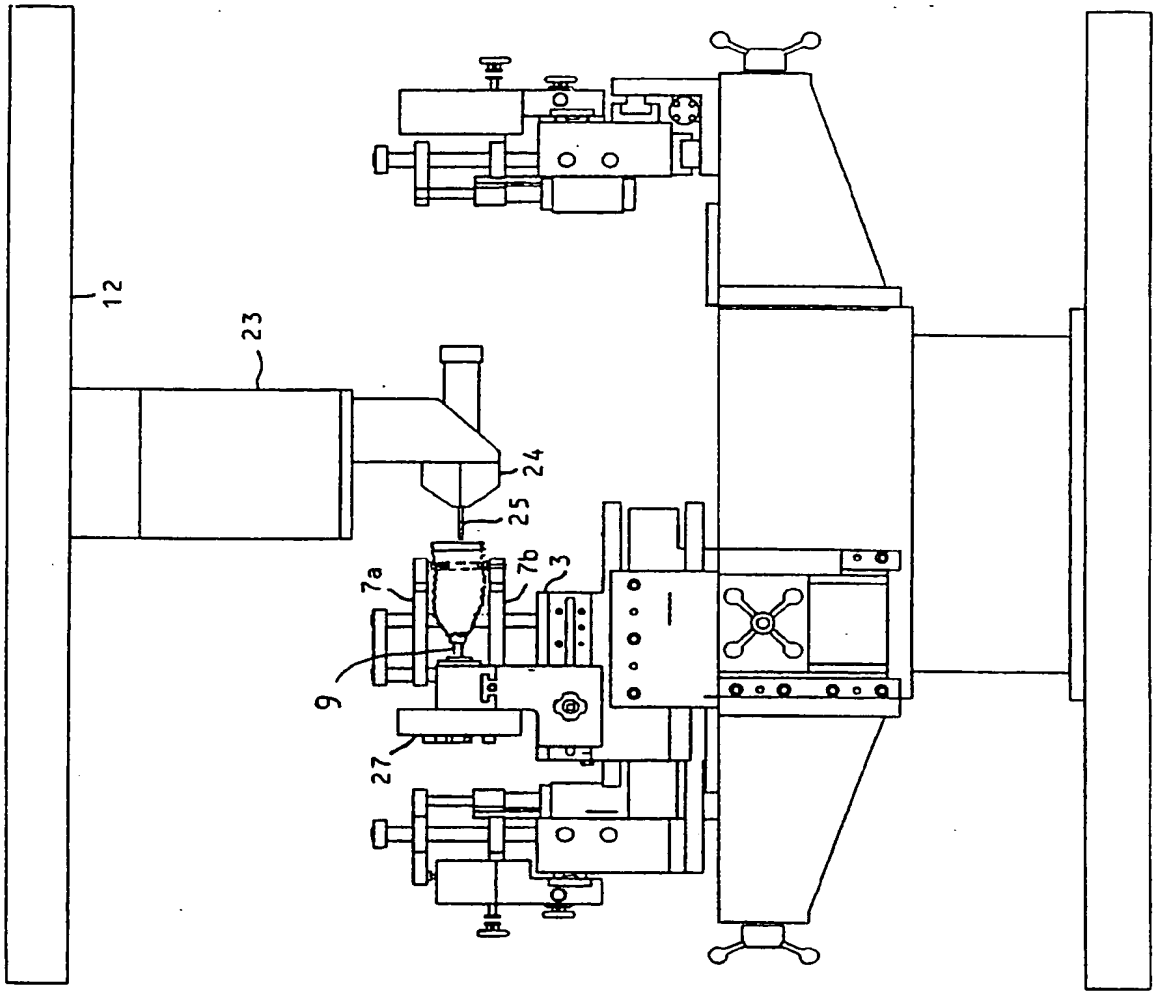


FIG. 5



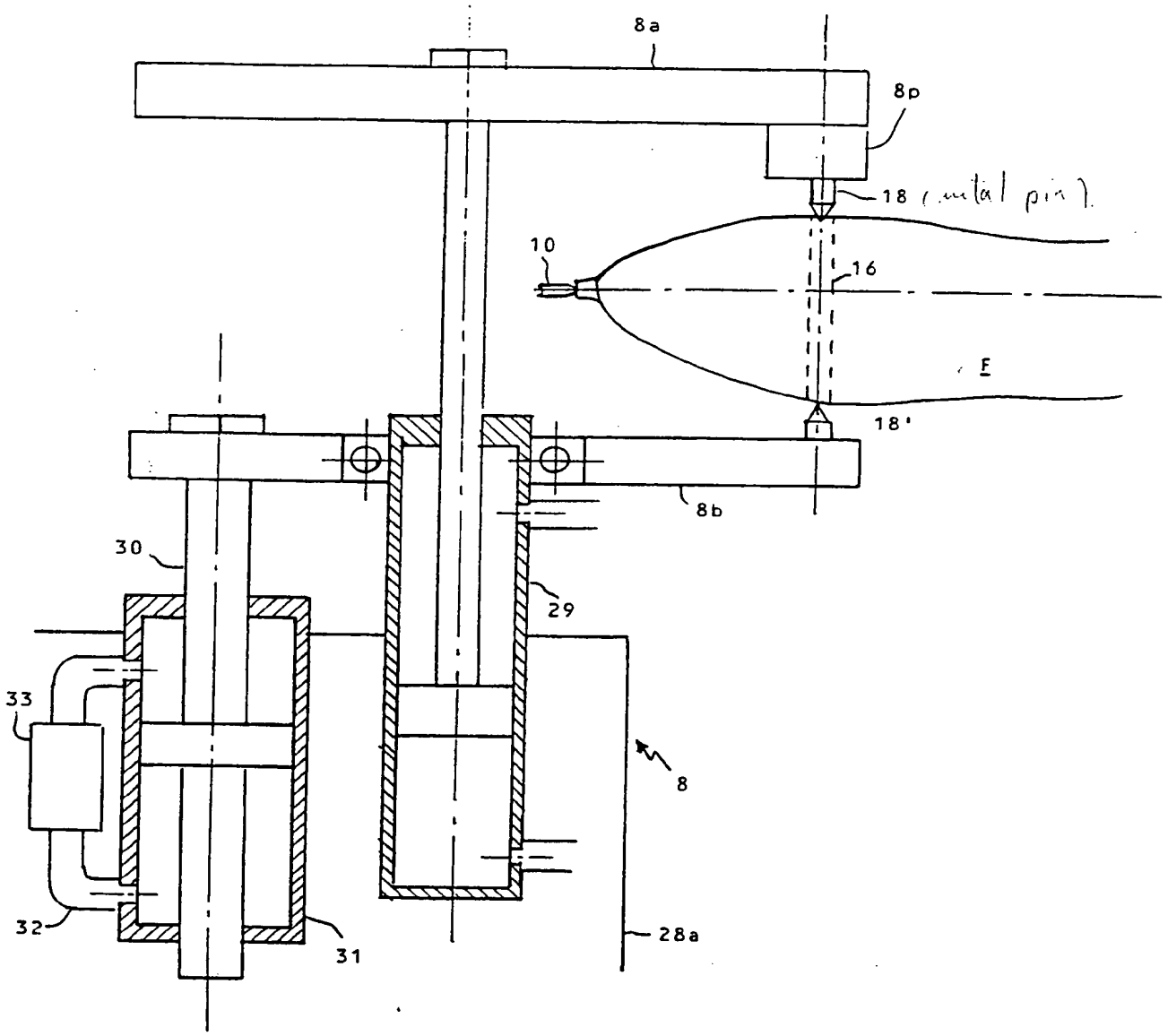


FIG. 6

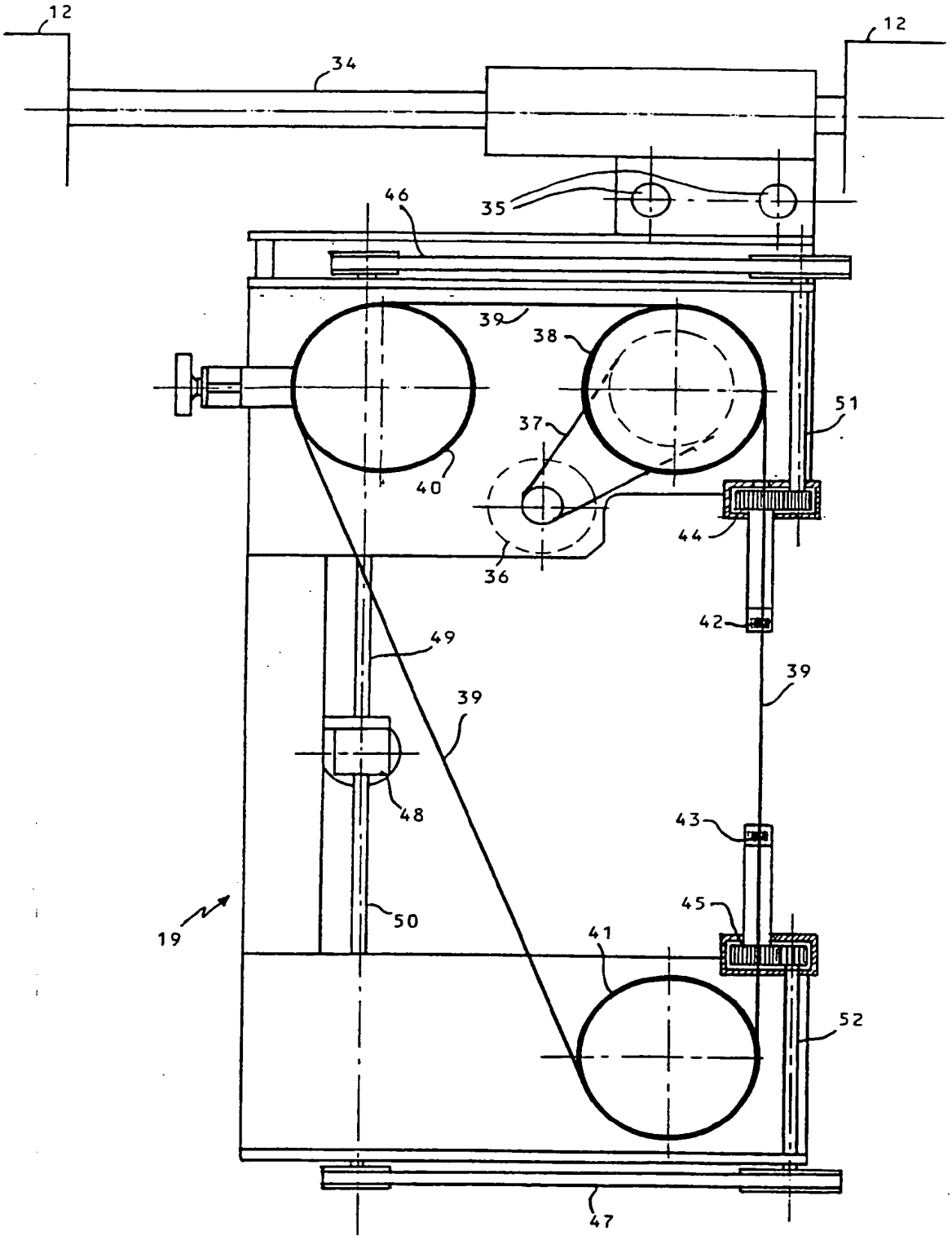


FIG. 7

INTERNATIONAL SEARCH REPORT

Interr ial Application No
PCT/IT 94/00212

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A43D3/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A43D B27M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP,A,0 267 606 (SPRECA-ZENGARINI & C. S.N.C.) 18 May 1988 see claims; figures	1-5
Y	PATENT ABSTRACTS OF JAPAN vol. 4, no. 68 (M-012) 21 May 1980 & JP,A,55 031 511 (SEIKO SEIKI CO LTD) 5 March 1980 see abstract	1-5
A	EP,A,0 242 222 (BATA IND LTD) 21 October 1987	
A	WO,A,91 17677 (FOOT IMAGE TECH INC) 28 November 1991	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search	Date of mailing of the international search report
29 March 1995	07. 04 95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Soederberg, J

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

...formation on patent family members

Inter ...al Application No
PCT/IT 94/00212

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